Towards a Chemical Taxonomy of Comets: A Critical Comparison of Two Infrared Spectroscopic Methods for Quantitative Measurements of Cometary Water.

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An intense cometary bombardment during the early stages of Earth history might have played a major role in delivering the water and organics that subsequently formed the biosphere. Consequently, the chemical composition of the cometary nucleus (and its diversity) is a key issue for astrobiology. While comets are often grouped according to their orbital properties, it is increasingly clear that such groups likely contain comets formed in diverse regions of the proto-planetary disk. In recent years the emergence of accurate abundance measurements has begun to permit a taxonomic classification based on chemistry.

H_2O is the principal parent volatile in comets and its sublimation controls the release of other volatiles within 3-4 AU from the Sun. Accurate quantitative production rates of water are critical because they provide the "baseline" for comparison with organic species; their simultaneous measurement eliminates many sources of systematic error. Two methods for deriving cometary water production rates from ground-based high-resolution infrared spectra have now been developed. The H_2O population can be directly sampled through "hot-band" fluorescent emission [Dello Russo et al. 2000, Icarus]. More recently, vibrational prompt emission from OH has also been used as a proxy for water production [Bonev et al. 2004, ApJ]. In this presentation we critically review the two methods using specific examples from recently analyzed comet data.

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